

## SECTION 26 2500

### ENCLOSED BUS ASSEMBLIES

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#### LANL MASTER SPECIFICATION

When editing to suit project, author shall add job-specific requirements and delete only those portions that in no way apply to the activity (e.g., a component that does not apply). To seek a variance from applicable requirements, contact the ESM Electrical POC.

When assembling a specification package, include applicable specifications from all Divisions, especially Division 1, General Requirements.

Delete information within "stars" during editing.

Specification developed for ML-3 projects. For ML-1 / ML-2, additional requirements and QA reviews are required.

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#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

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Edit the following articles to match project requirements.

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- A. Low-voltage feeder bus assemblies.
- B. Low-voltage plug-in bus assemblies.
- C. Bus plug-in devices.

##### 1.2 SUBMITTALS

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Edit the following articles to match project requirements.

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- A. Submit the following in accordance with Section 01 3300, Submittal Procedures:
  - 1. Shop Drawings: For each type of enclosed bus assembly:
    - a. Submit fabrication and installation details for enclosed bus assemblies based on field measurements. Include plans, elevations, and sections of components. Identify components and accessories, including clamps, brackets, hanger rods, connectors, straight lengths, and fittings.
    - b. Show fittings, materials, fabrication, and installation methods for [listed fire-stop barriers] [and] [weather barriers].

- c. Indicate required clearances, method of field assembly, and location and size of each field connection.
  - d. Detail connections to transformers, switchgear, switchboards, motor control centers, and other system components.
  - e. Submit seismic-restraint details, signed and sealed by a qualified registered professional engineer. Include calculations for selecting seismic restraints and details of fabrication, anchorages, and attachments to structure and to supported equipment
- 2. Wiring Diagrams: Submit power wiring diagram showing phasing of the busway system where it interfaces with transformers, switchgear, switchboards, motor control centers, and other system components.
- 3. Coordination Drawings: Submit floor plans and sections, drawn to scale and based on field measurements. Include scaled bus-assembly layouts and relationships between components and adjacent structural, mechanical, and electrical elements. Show the following:
  - a. Vertical and horizontal enclosed bus-assembly runs, offsets, and transitions,
  - b. Clearances for access above and to the side of enclosed bus assemblies,
  - c. Vertical elevation of enclosed bus assemblies above the floor or bottom of structure above,
  - d. Support locations, type of support, and weight on each support, and
  - e. Location of adjacent construction elements including light fixtures, HVAC and plumbing equipment, fire sprinklers and piping, signal and control devices, and other equipment.
- 4. Catalog Data: Submit manufacturer's descriptive and technical literature describing each type of enclosed bus assembly, fitting, bus plug-in device, and accessory item. Include data substantiating that materials and equipment comply with specified requirements.
- 5. Certification: Submit certification and backup information that enclosed bus assemblies can perform required functions after a design earthquake as specified in "SERVICE CONDITIONS" below.
  - a. Enclosed bus assemblies designated with  $I_p$  greater than 1.0 shall be certified by the manufacturer to withstand the total lateral seismic force and seismic relative displacements specified in the International Building Code (IBC) or ASCE 7, "Minimum Design Loads for Buildings and Other Structures."

- b. Certification shall be based on shake table testing or experience data (i.e., historical data demonstrating acceptable seismic performance), or by more rigorous analysis providing for equivalent safety.
  - c. Required response spectra shall exceed 1.1 times the in-structure spectra determined in accordance with IBC AC156, "Acceptance Criteria for Seismic Qualification by Shake-Table Testing of Nonstructural Components and Systems."
- 6. Certification: Submit certification by manufacturer's field technical representative that the contractor has installed, adjusted, and tested the enclosed bus assemblies according to the manufacturer's recommendations.
- 7. Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified in "QUALITY ASSURANCE." Include instructions for storage, handling, protection, examination, installation, and starting of Product, including equipment anchoring requirements to meet the seismic conditions specified in "SERVICE CONDITIONS."
- 8. Operation and Maintenance Instructions: Submit complete operation and maintenance instructions including step-by-step start-up, operating, shutdown, inspection, and maintenance procedures.

### 1.3 QUALITY ASSURANCE

- A. Provide products that are listed to the current edition of UL 857, "Standard for Safety for Busways", by a Nationally Recognized Testing Laboratory (NRTL) for the application and for the operating environment in which installed.
- B. Comply with the National Electrical Code (NEC) for components and installation.
- C. Comply with NEMA BU 1, "Busways."
- D. Obtain enclosed bus assemblies through one source from a single manufacturer.
- E. Provide enclosed busway assemblies manufactured in a certified ISO 9001 facility.

### 1.4 RECEIVING, STORING AND PROTECTING

- A. Receive, inspect, handle, and store enclosed bus assemblies according to:
  - 1. The manufacturer's written instructions,
  - 2. NEMA BU1.1, "General Instructions for Handling, Installation, Operation, and Maintenance of Busway Rated 600 Volts or Less", and
  - 3. NECA 408, "Recommended Practice for Installing and Maintaining Busways."

- B. Protect equipment placed in storage from humidity and temperature variations, dirt, dust, or other contaminants.

## 1.5 SERVICE CONDITIONS

- A. Provide enclosed bus assemblies and accessories that will perform satisfactorily in any combination the following service conditions without mechanical or electrical damage or degradation of operating characteristics:
  - 1. Operating elevation of 7500 feet above sea level.
  - 2. Operating ambient temperature of 104 degrees F, 40 degrees C.
  - 3. International Building Code seismic criteria:
    - a. Seismic Design Category = D
    - b. SDS = spectral acceleration, short period = 0.54g
    - c.  $a_p$  = component amplification factor = 1.0
    - d.  $R_p$  = component response modification factor = 2.5
    - e.  $I_p$  = Component importance factor  
 $I_p = 1.5$  for life safety related components such as emergency systems  
 $I_p = 1.5$  for safety class or safety significant systems  
 $I_p = 1.0$  for all other applications

## 1.6 COORDINATION

- A. Coordinate layout and installation of enclosed bus assemblies and suspension system with other construction that penetrates ceilings or floors or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.
- B. Coordinate size and location of concrete curbs around openings for vertical bus. Concrete, reinforcement, and formwork requirements are specified in Division 03.

## 1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and are packaged with protective covering for storage and identified with labels describing contents:
  - 1. One spray can of touch-up paint for each 100 feet of enclosed bus assembly; minimum of one can.
  - 2. One set of special tools required for assembly, operation, and maintenance of the enclosed bus assembly and plug-in units.

3. 10 percent of the amount of bus plug-in units, but no less than one unit, for each size installed.

## PART 2 PRODUCTS

### 2.1 PRODUCT OPTIONS AND SUBSTITUTIONS

- A. Alternate products may be accepted; follow Section 01 2500, "SUBSTITUTION PROCEDURES."

### 2.2 MANUFACTURERS

- A. SUBJECT to compliance with requirements, provide products by one of the following:
  1. Eaton Electrical Inc.; Cutler-Hammer Products: "Pow-R-Way III"
  2. General Electric Company: "Spectra Series"
  3. Siemens Energy & Automation, Inc.: "Sentron"
  4. Square D; Schneider Electric: "I-LINE II"

### 2.3 ENCLOSED BUS ASSEMBLIES

- A. Feeder-Bus Assemblies: Provide NEMA BU 1, low-impedance feeder bus assemblies in nonventilated housing with one-bolt type joints and the following ratings and materials:
  1. Seismic Fabrication Requirements: Fabricate mounting provisions and attachments for feeder-bus assemblies with reinforcement strong enough to withstand seismic forces defined in "SERVICE CONDITIONS" when mounting provisions and attachments are anchored to building structure.

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Edit the following articles to match project requirements; refer to manufacturer's catalog data for standard ratings. If several ratings are required, indicate them on the Drawings.

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2. Voltage: [208Y/120] [240] [480] [480Y/277] volts [as indicated on the Drawings]; 3 phase; [100] [200] [percent neutral capacity] [as indicated on the Drawings].
3. Current rating: [800] [1000] [1200] [1350] [1600] [2000] [2500] [3000] [4000] [5000] amperes [as indicated on the Drawings].
4. Short circuit withstand rating (6 cycles): [85,000] [100,000] [125,000] [150,000] [200,000] amperes RMS symmetrical [as indicated on the Drawings]

5. Temperature Rise: 55 deg C above 40 deg C ambient maximum for continuous rated current.
  6. Bus Materials: Current-carrying copper conductors fully insulated with Class 130C insulation except at joints; silver plated surface at joints.
  7. Ground: 50 percent capacity internal copper bus bar.
  8. Enclosure:
    - a. Indoors: Steel or aluminum with manufacturer's standard finish.
    - b. Outdoors: Weatherproof, steel or aluminum with manufacturer's standard finish, sealed seams, drains, and removable closures.
  9. Fittings and Accessories: Provide manufacturer's standard fittings and accessories as required for a complete installation.
  10. Mounting: Provide busway designed for flat, edgewise, or vertical installation without derating.
- B. Plug-in Bus Assemblies: Provide NEMA BU 1, low-impedance plug-in bus assemblies in nonventilated housing with one-bolt type joints and the following ratings and materials:
1. Seismic Fabrication Requirements: Fabricate mounting provisions and attachments for feeder-bus assemblies with reinforcement strong enough to withstand seismic forces defined in "SERVICE CONDITIONS" when mounting provisions and attachments are anchored to building structure.

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3. Current rating: [800] [1000] [1200] [1350] [1600] [2000] [2500] [3000] [4000] [5000] amperes [as indicated on the Drawings].
4. Short circuit withstand rating (6 cycles): [85,000] [100,000] [125,000] [150,000] [200,000] amperes RMS symmetrical [as indicated on the Drawings]
5. Temperature Rise: 55 deg C above 40 deg C ambient maximum for continuous rated current.

6. Bus Materials: Current-carrying copper conductors fully insulated with Class 130C insulation except at stabs and joints; silver plated surface at stabs and joints.
7. Ground: 50 percent capacity internal copper bus bar.
8. Enclosure: Steel or aluminum with manufacturer's standard finish, plug-in openings 24 inches on-center, and hinged covers over unused openings.
9. Fittings and Accessories: Provide manufacturer's standard fittings and accessories as required for a complete installation.
10. Mounting: Provide busway designed for flat, edgewise, or vertical installation without derating.

## 2.4 BUS PLUG-IN DEVICES

- A. Provide bus plug-in devices with NEMA AB 1 molded-case circuit breakers having current, voltage, and interrupting ratings as indicated on the Drawings.
- B. Provide plug-in devices that mechanically interlock with the busway housing to prevent installation or removal when the circuit breaker is in the ON position.
- C. Provide plug-in devices with hookstick-operated handle, lockable with two padlocks, and interlocked with cover in closed position.
- D. Provide plug-in devices that will make a positive ground connection to the busway housing before the stabs make contact with the bus bars.
- E. Provide plug-in devices with housing ground terminal for connecting equipment ground wire.
- F. Provide one hookstick operator for each 400 feet of plug-in busway, minimum of one hookstick operator; adjustable to maximum extension of 14 feet.

## PART 3 EXECUTION

### 3.1 EXISTING WORK

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Delete this article when existing construction is not affected.

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- A. Disconnect and remove each abandoned enclosed bus assembly.
- B. Disconnect and remove each abandoned bus plug-in device; deliver serviceable devices to Facility Operations Director's representative.
- C. Maintain access to each existing enclosed bus assembly that is to remain active.

- D. Clean and repair each existing enclosed bus assembly or bus plug-in device that is to remain or be reinstalled.

### 3.2 EXAMINATION

- A. Examine spaces and surfaces to receive enclosed bus assemblies for compliance with installation tolerances and other conditions affecting performance of the product. Do not proceed with installation until unsatisfactory conditions are corrected.

### 3.3 INSTALLATION

- A. Install enclosed bus assemblies where indicated on the Drawings and according to the approved shop drawings, the manufacturer's instructions, NEMA BU 1.1, NECA 408, and the NEC. Have the manufacturer's installation instructions available at the construction site.
- B. Provide supports and seismic anchorage in accordance with the manufacturer's installation instructions and requirements of Section 26 0529, "Hangers and Supports for Electrical Systems."
  - 1. Support bus assemblies independent of supports for other elements such as equipment enclosures at connections to panelboards and switchboards, pipes, conduits, ceilings, and ducts.
  - 2. Design each fastener and support to carry load indicated by seismic requirements and to comply with seismic-restraint details according to Section 26 0529, "Hangers and Supports for Electrical Systems."
- C. Position enclosed bus assemblies with sufficient vertical and horizontal clearance so each joint will be accessible for inspection and each joint bolt will be accessible for re-torquing using a standard torque wrench. Provide access doors as required.
- D. Install expansion fittings at locations where bus assemblies cross building expansion joints. Install at other locations so distance between expansion fittings does not exceed manufacturer's recommended distance between fittings.
- E. Construct rated fire-stop assemblies where bus assemblies penetrate fire-rated elements such as walls, floors, and ceilings. Seal around penetrations according to Section 07 8400, "Firestopping."
- F. Install weather seal fittings and flanges where bus assemblies penetrate exterior elements such as walls or roofs. Seal around openings to make weather tight. See Section 07 9200, "Joint Sealants" for materials and application.
- G. Install a concrete curb at least 4 inches high around floor penetrations.
- H. Coordinate bus-assembly terminations to equipment enclosures to ensure proper phasing, connection, and closure.



- I. Tighten bus-assembly joints with torque wrench or similar tool recommended by bus-assembly manufacturer. Tighten joints again after bus assemblies have been energized for 30 days.
- J. Install bus-assembly, plug-in units. Support connecting conduit independent of plug-in unit.

### 3.4 CONNECTIONS

- A. Ground and bond enclosed bus assembly as required in Section 26 0526, Grounding and Bonding for Electrical Systems.
- B. Install conduit connections to enclosed bus assemblies as required in Section 26 0533, Raceways and Boxes for Electrical Systems.
- C. Install conductors as required in Section 26 0519, Low Voltage Electrical Power Conductors and Cables.

### 3.5 IDENTIFICATION

- A. Identify enclosed bus assemblies and plug-in devices and install warning signs and arc-flash warning labels as required in Section 26 0553, "Identification for Electrical Systems."
- B. Provide engraved laminated Category I nameplate for each bus plug-in device. Refer to Section 26 0553, "Identification for Electrical Systems."

### 3.6 FIELD QUALITY CONTROL

- A. Clean, inspect, test, and energize installed enclosed bus assemblies in accordance with the manufacturer's instructions, NEMA BU 1.1, and NECA 408.
- B. After completing installation, cleaning, and testing, touch up scratches and mars on finish to match original finish.
- C. Provide the services of a factory trained representative from the manufacturer who is experienced in the installation, adjustment, and operation of the equipment specified to inspect and certify the installation and to oversee energizing and testing.
- D. Perform acceptance inspection and tests as required by Section 26 0813, "Electrical Acceptance Testing."
- E. Remove and replace units that do not pass tests and inspections and retest as specified above.
- F. Infrared Scanning: Two months after Substantial Completion, perform an infrared scan of bus assembly including joints and plug-in units.

1. Use an infrared-scanning device designed to measure temperature or detect significant deviations from normal values. Provide documentation of device calibration.
  2. Perform 2 follow-up infrared scans of bus assembly, one at 4 months and the other at 11 months after Substantial Completion.
  3. Prepare a certified report identifying bus assembly checked and describing results of scanning. Include notation of deficiencies detected, remedial action taken, and scanning observations after remedial action.
- G. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

### 3.7 ADJUSTING

- A. Set field-adjustable, circuit-breaker trip ranges as indicated on the Drawings or the final coordination study; refer to Section 26 0813, Electrical Acceptance Testing.

### 3.8 CLEANING

- A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

### 3.9 PROTECTION

- A. Provide final protection to ensure that moisture does not enter bus assembly.

## END OF SECTION

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Do not delete the following reference information.

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## FOR LANL USE ONLY

This project specification is based on LANL Master Specification 26 2500 Rev. 0, dated September 14, 2006.